



Name: \_\_\_\_\_ Date: \_\_\_\_\_ Per: \_\_\_\_\_

# P-B-L SCIENCE

## PROBLEM-BASED LEARNING

### Is The Packaging Half Full Or Half Empty?

#### The Problem

Consumers often complain that the contents of common packaged goods, such as potato chips and breakfast cereals, do not fill the entire available space of the package. When this partial packaging occurs, consumers feel deceived. On the other hand, consumers experience frustration when they receive goods that are over packaged, such as goods that are double-wrapped in heavy plastic, or goods that are double-boxed then individually wrapped. The United States lags behind Europe and Canada in the effort to reduce packaging waste. In the United States, one-third of all consumer trash is generated from packaging. According to the Environmental Protection Agency, the United States generated almost 14 million tons of plastics packaging solid waste in 2007. If this trend continues, the effects on the environment will be detrimental.

#### Guiding Question

How can density concepts be applied to achieve efficient packaging?

#### Mission Deliverable

Your mission is to apply density concepts to design an efficient, environmentally-friendly package for a common consumer product.

#### Key Concepts Addressed

1. Density is a measure of how much of a substance is packed into a space.
2. Density is measured by comparing an object's mass (the amount of matter in a substance) and its volume (the amount of space a substance fills up.)
3. The density of an unknown substance can be calculated by dividing its mass (in grams) by its volume (in mL or  $\text{cm}^3$ ) using the following formula  $D = m/V$ .

#### Performance /College & Career Readiness Goals

##### Science Standards

- VIII. Physics  
A. Matter
4. Understand the concept of density.
- X. Environmental Science  
E. Human Practices and Their Impacts
5. Understand how human practices affect air, water, and soil quality.

##### Cross-Disciplinary Standards

- I. Key Cognitive Skills  
A. Problem Solving
3. Analyze a situation to identify a problem to be solved.



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## Is The Packaging Half Full Or Half Empty?

### Student Checklist

#### Getting Started

[Brightstorm Videos: "Density"](#)

#### Resources

[The History of Packaging](#)

[CAL Recycle](#)  
["Use Less Packaging And Reduce Waste"](#)

[Environmentally Friendly Packaging](#)

[Organic Consumers Association: Boys Encourage Environmentally Friendly Toy Packaging](#)

TASK	RESOURCES	DUE DATE	STATUS/NOTES
Research the following:  1.Density 2.History of packaging 3.The connection between density concepts and packaging 4.Waste 5.Landfills 6.How consumer goods are packaged 7.Impact of over packaging on the environment 8.Environmentally-friendly packaging options	1. Mac or PC Computer 2. Internet		<input type="checkbox"/> Complete <input type="checkbox"/> Not Complete



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## Is The Packaging Half Full Or Half Empty?

### Student Checklist, continued

TASK	RESOURCES	DUE DATE	STATUS/NOTES
Interview an environmental scientist. During this interview, you should confirm the information that you researched in the first task.	<ol style="list-style-type: none"> <li>1. Mac or PC Computer</li> <li>2. Environmental Scientist</li> </ol>		<input type="checkbox"/> Complete <input type="checkbox"/> Not Complete
Research the following information for one common packaged consumer product:  <ol style="list-style-type: none"> <li>1.Manufacturer</li> <li>2.Mass of contents</li> <li>3.Available packaging space for the contents</li> <li>4.Price</li> </ol>	<ol style="list-style-type: none"> <li>1. Packaged Consumer Product</li> <li>2. PC or Mac Computer</li> <li>3. Internet</li> </ol>		<input type="checkbox"/> Complete <input type="checkbox"/> Not Complete
Re-design the packaging for the product that you researched in the previous task. Your “improved package design” should be efficient and environmentally friendly.	<ol style="list-style-type: none"> <li>1. Packaged Consumer Product</li> <li>2. PC or Mac Computer</li> <li>3. Internet</li> <li>4. Sketching/Drawing Materials</li> <li>5. Sketching/Drawing software</li> </ol>		<input type="checkbox"/> Complete <input type="checkbox"/> Not Complete
Submit your “Improved package design” to the product’s manufacturer. You may submit this design to either the “Research & Development” or “Marketing” departments.	<ol style="list-style-type: none"> <li>1. Completed “Improved package design”</li> <li>2. Postage</li> </ol>		<input type="checkbox"/> Complete <input type="checkbox"/> Not Complete
FINAL DUE DATE:			



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### Rubric and Grade Sheet

Category	Exceeds Expectations 3 points	Meets Expectations 2 points	Below Expectations 1 point	SCORE	Teacher Comments
<b>Content Mastery</b>	Included detail on <b>all</b> components and SCOPE Key Concepts.	Included some detail on <b>most</b> components and SCOPE Key Concepts.	Included <b>little to no</b> detail on components and SCOPE Key Concepts.		
<b>Application of Content</b>	Student correctly supported <b>all</b> SCOPE content AND goals.	Student correctly supported <b>most</b> SCOPE content AND goals.	Student <b>did not</b> support SCOPE content AND goals.		
<b>Research</b>	All information is accurate and is taken from at least four sources.	Most information is accurate and is taken from two to three sources.	Little to no information is accurate and is taken from one to no sources.		
<b>Presentation</b>	Final product is attractive, all components are easily identified, and the student can clearly dialogue about the project.	Final product is somewhat attractive, most components are easily identifiable, and the student can somewhat dialogue about the project.	Final product is not presented well, components are difficult to identify, and the student cannot clearly dialogue about the project.		
				<b>TOTAL SCORE:</b>	



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## Appendix: Is The Packaging Half Full Or Half Empty?

### Internet Resources

RESOURCE	URL
Brightstorm Videos: "Density"	<a href="http://www.brightstorm.com/science/physics/solids-liquids-and-gases/density/">http://www.brightstorm.com/science/physics/solids-liquids-and-gases/density/</a>
The History of Packaging	<a href="http://www.bagmanofcantley.co.uk/html/history_of_packaging.html">http://www.bagmanofcantley.co.uk/html/history_of_packaging.html</a>
CAL Recycle: "Use Less Packaging And Reduce Waste"	<a href="http://www.calrecycle.ca.gov/ReduceWaste/Business/factsheets/Package.htm">http://www.calrecycle.ca.gov/ReduceWaste/Business/factsheets/Package.htm</a>
Environmentally-Friendly Packaging	<a href="http://www.ecoevaluator.com/lifestyle/shopping/environmentally-friendly-packaging.html">http://www.ecoevaluator.com/lifestyle/shopping/environmentally-friendly-packaging.html</a>
Organic Consumers Association: Boys Encourage Environmentally-Friendly Toy Packaging	<a href="http://www.organicconsumers.org/articles/article_16318.cfm">http://www.organicconsumers.org/articles/article_16318.cfm</a>

